| | | | |
|---|---|---|---|
| | **P.E.S. COLLEGE OF ENGINEERING**<br>**(AN AUTONOMOUS INSTITUTE)**<br>**CHH. SAMBHAJINAGAR-431002**<br>**Regular Winter Examination – 2025**<br>**Course: F.Y.M. Tech. Branch : EE (EPS) Semester : I**<br>**Subject Code & Name : MTPESEPS103T/A Smart Grid Design & Analysis**<br>**Max Marks: 60 Date: Duration: 3 Hr.** | | |
| | ***Instructions to the Students:***<br>*1. All the questions are compulsory.*<br>*2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*<br>*3. Use of non-programmable scientific calculators is allowed.*<br>*4. Assume suitable data wherever necessary and mention it clearly.* | | |
| | | (Level/CO) | Marks |
| **Q. 1** | **Solve Any one of the following.** | | |
| **A)** | Describe the current status of the smart grid in India (Indian Smart Grid) and discuss at least three key challenges it faces<br>• **Marking Scheme:**<br>  • Current status of Indian Smart Grid (policies, pilots, missions) – **4 marks**<br>  • Explanation of any three challenges – **6 marks** (2 × 3)<br>  • Examples / justification / clarity – **2 marks**<br>• **Total:** 12 marks | **L5/CO1** | **12** |
| **B)** | Identify and explain major market drivers for the smart grid, and discuss the stakeholder roles and functions in the smart-grid ecosystem.<br>• **Marking Scheme:**<br>  • Major market drivers (policy, reliability, RES, economics, etc.) – **6 marks**<br>  • Stakeholders and their roles/functions – **6 marks**<br>• **Total:** 12 marks | **L4/CO1** | **12** |
| | | | |
| **Q.2** | **Solve Any one of the following.** | | |
| **A)** | Describe the features and roles of smart meters and advanced metering infrastructure (AMI) in the smart grid.<br>□ **Marking Scheme:**<br>  • Features of smart meters & AMI – **6 marks**<br>  • Roles/functions in smart grid operation – **6 marks**<br>□ **Total:** 12 marks | **L3/CO2** | **12** |
| **B)** | Explain the working principle of a Phasor Measurement Unit (PMU) and how it contributes to wide-area monitoring in a smart grid.<br>□ **Marking Scheme:**<br>  • Working principle of PMU – **6 marks**<br>  • Contribution to wide-area monitoring (WAMS) – **6 marks**<br>□ **Total:** 12 marks | **L4/CO2** | **12** |
| | | | |
| **Q. 3** | **Solve Any one of the following.** | | |
| **A)** | Describe "state-of-the-art" load-flow methodologies: classical, extended formulations and algorithms.<br>• **Marking Scheme:** | **L4/CO3** | **12** |

| | | | |
|---|---|---|---|
| | • Classical load-flow methods – **4 marks**<br>• Extended formulations – **4 marks**<br>• Modern algorithms – **4 marks**<br>• **Total:** 12 marks | | |
| **B)** | What challenges do smart-grid features impose on traditional load-flow methods? Identify weaknesses of the present load-flow methods in the context of a smart grid.<br>• **Marking Scheme:**<br>• Smart-grid challenges (RES, bidirectional flow, uncertainty) – **6 marks**<br>• Weaknesses of traditional load-flow methods – **6 marks**<br>• **Total:** 12 marks | **L5/CO3** | **12** |
| | | | |
| **Q.4** | **Solve Any one of the following.** | | |
| **A)** | What is state estimation in a smart grid, and how does the smart-grid approach differ from traditional state estimation methods?<br>• **Marking Scheme:**<br>• Concept of state estimation – **4 marks**<br>• Smart-grid approach vs traditional methods – **8 marks**<br>• **Total:** 12 marks | **L4/CO4** | **12** |
| **B)** | Discuss how energy management in a smart grid supports stability (both voltage and angle) and the role of advanced control techniques.<br>• **Marking Scheme:**<br>• Energy management supporting voltage & angle stability – **6 marks**<br>• Role of advanced control techniques – **6 marks**<br>• **Total:** 12 marks | **L4/CO4** | **12** |
| | | | |
| **Q. 5** | **Solve Any one of the following.** | | |
| **A)** | Discuss major storage technologies used in smart grid systems and the key grid integration issues of renewable energy sources.<br>• **Marking Scheme:**<br>• Storage technologies (batteries, flywheels, etc.) – **6 marks**<br>• Grid-integration issues of renewable energy – **6 marks**<br>• **Total:** 12 marks | **L4/CO5** | **12** |
| **B)** | Explain demand-response strategies in a smart grid and how they work in conjunction with renewable energy and storage.<br>• **Marking Scheme:**<br>• Demand-response strategies – **6 marks**<br>• Coordination with RES & storage – **6 marks**<br>• **Total:** 12 marks | **L4/CO5** | **12** |
| | ***** End ***** | | |